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Driver's Education: A "Motor" Learning Analogy

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INTRODUCTION

In recent years, motor learning theory has been receiving increased attention from voice pedagogues. Over the last dozen years, for instance, the "Mindful Voice" column of this journal has featured articles on the topic written by Lynn Helding, Christine Bergan, John Nix, and Lynn Maxfield.[1] In fact, Helding feels so strongly about the influence of motor learning on her career that she credits Katherine Verdolini Abbott with exposing her to the theory that she calls "my Holy Grail."[2]

As discussions of motor learning and its applications to voice work increasingly abound in the literature,[3] a concise but useful description is provided in *The Vocal Athlete* by Wendy D. LeBorgne and Marci Rosenberg, who outline the three primary stages of motor learning.[4]

As the authors describe, the first stage is called the *verbal/cognitive stage*. Learners in this stage are just getting the "feel" of a movement through verbal, tactile, and other sensory cues. This stage requires significant attention to the task they intend to learn and many repetitions of that task. In this stage, learners benefit from regular guidance from teachers, who validate their successful attempts and offer corrections after failed attempts.

In the second stage, the *motor learning stage*, learners have established a basic grasp of the movements required to perform the task. They then start to refine those movements, which allows them to execute the task more consistently and efficiently. They also begin to recognize and correct their errors without the input of a teacher. Therefore, in this stage, teachers can reduce the amount of guidance offered and adjust feedback in a way that encourages learners to begin developing their own self-diagnosis skills.

The third and final stage is called the *automatic stage* because the learners' skills are literally becoming more automatic. Learners are consistently effective in performing the task and can do so in different settings and amid distractions. Logically, less and less teacher feedback is needed as learners are able to effectively self-diagnose and provide feedback for themselves.

As I have become familiar with the stages of motor learning, I have been calling students' attention to which stage they feel they may be in on certain vocal skills. I find that asking them thoughtfully to consider where they are in their progression through these stages keeps them engaged and invested in their own learning by helping them understand the characteristics of the benchmarks they are working to achieve. It also

helps them interpret the feedback I provide, which sometimes includes withholding possible solutions in the interest of helping them develop their abilities to self-diagnose.

Highlighting the stages of motor learning has an additional benefit. Many students naturally assume that if they are unable to perform certain vocal tasks, it is because they are not "talented" or that they lack the abilities that other singers possess. When they instead recognize that they are simply in one of the first two stages of motor learning of those specific skills, it can shift their mindset. Identifying in which stage they are is an assessment rather than a conviction. When an accurate assessment is made, the path forward is clearer and steps can be undertaken without assigning a negative value judgment on where students are in their journey.

Therefore, in order to help students comprehend and remember the three stages of motor learning, I compare learning how to sing to learning how to drive. In addition to what I hope to be the relatability of this analogy (assuming that even those who have never driven a car themselves have likely seen one operated up close), there is the double meaning of the word "motor." Although motor learning refers to muscles and the body, the secondary association with the engine of a vehicle can remind students of the following analogy.

DRIVING PRIVILEGES

Learning how to drive was an important rite of passage for my classmates and me in our early teen years. In small town Iowa, dramatically more social possibilities were available to those who had a driver's license and a working vehicle (the operative word being "working," since the clunkers in our family's driveway were usually anything but reliable). License holders could drive to neighboring towns to visit restaurants, stores, and movie theaters not found on our own Main Street. Drivers could forgo embarrassing parental supervision on dates or trips to school dances. Lastly, but significantly, those with a set of wheels could spend endless hours engaging in our favorite pastime of "cruising the strip," in other words, circling the roughly one-mile stretch between the Casey's General Store on the west side of town and the one on the east side of town.

Therefore, once I was old enough, I was eager and motivated to earn my driver's license and to revel in all the benefits and freedom it would provide.

DECLARATIVE LEARNING VS. PROCEDURAL LEARNING

The first step in this process was to pass a written test so I could get my learner's permit (now called an "instruction permit"). To do this, I studied DMV materials and took practice tests until I possessed a basic knowledge of policies, laws, and general rules of the road. By passing the official written exam, I demonstrated declarative learning, or "book learning."[5] Studying for that exam did not teach me how much to adjust the steering wheel when making a right turn or how much pressure to apply to the gas pedal to maintain a steady speed. Those are physical tasks that come about from procedural learning, also known as "muscle or motor learning."[6] Rather, the information that I studied and memorized provided a base of know-how that would inform many of my decisions once I was in the driver's seat.

When I had earned my learner's permit, I was allowed to enroll in a driver's education course that took place the summer after my 9th-grade year. This course began with a weeks-long class component that continued to focus on declarative learning through assigned readings, class lectures, and additional written exams.

However, the course also required that each student log a set number of hours of driving under the supervision of an instructor. In addition, we were expected to continue practicing our driving under the guidance of a parent or guardian. It was during these hours behind the wheel that we would progress through the three stages of motor learning.

VERBAL/COGNITIVE STAGE

During my first supervised driving trip, the initial task my instructor asked of me was to drive around an empty parking lot, just to make sure I could stop and start smoothly and safely maneuver the car. He gave me step by step directions to make sure I did everything right: "Put your hands on the steering wheel at ten o'clock and two o'clock. Press the brake and put the car into drive. Remove your foot from the brake and slowly press down on the gas pedal."

Once I was sufficiently capable of these basics, we headed out into the relatively uncrowded streets of my hometown. Instead of the wide open space of the parking lot, now I had curbs and lanes to negotiate around, complete with oncoming traffic reminding me of how important it is to not drift outside my designated lane.

When I was in this first stage of motor learning as a driver, my teacher was giving me nearly constant directions. He told me when to let up on the gas pedal and when to begin applying the brake for upcoming stop signs. He told me how far before an intersection I should activate my turn signal and he reminded me often to check the mirrors to see what was behind me. These directions seem ridiculously rudimentary now. It is a bit embarrassing to remember that I once had to be told, "You should probably put the car into park before you open the door to leave the vehicle." But, as a complete beginner, I needed these specific instructions and frequent reminders.

Of course, I made lots of mistakes. Given the potential seriousness of "failed attempts" when operating a motor vehicle, I understand why my instructor chose the relatively safe environs of an empty parking lot and the sparsely populated streets of a small town for my first driving experiences. Only when my skills progressed in those situations was I given the additional challenges of higher speed highway driving.

MOTOR LEARNING STAGE

Over a series of sessions, when my instructor felt I was ready, he eventually directed me onto the highway so I could see what it was like to drive at 55 mph. Instead of dealing with the immediate, as we did in town, he called my attention to what was farther off in the distance. At higher speeds, I had to think a couple of steps ahead, since I would approach obstacles that seemed far off much faster than before. Since this was Iowa, we would inevitably come up behind tractors, combines, or other slow moving agricultural vehicles. In these cases, my instructor would direct me to check my mirrors, watch the road ahead, use my turn signal, and safely pass on the left side of the road. Even though my basic skills of steering and acceleration had progressed to the second stage of motor learning (the motor learning stage), passing vehicles was a new task and required a first stage degree of feedback and instruction.

As I gradually demonstrated that I could perform most highway tasks without such explicit instructions from my teacher, his feedback shifted from directions to questions. As I was driving, he would ask me, "How fast are you going right now?" "Is anyone behind you?" "Is there a car in your blind spot?" "How many miles is it to the next town?" "What's the reading on your temperature gauge?" This called my attention to what was happening in the moment, allowed me to assess what I was doing, encouraged me to evaluate whether an action was needed or not, and helped me choose how to respond. In short, his questions were designed to help me learn how to self-diagnose.

Sometimes my teacher would articulate observations that would speculate about the future. I remember once he said, "I see that the car in front of us has an out of state license plate. I wonder if that driver has been on this road before. He may not know that the speed limit is about to drop because of the sharp turn ahead." In this way, he was teaching me to anticipate potential problems or hazards before they even came up—something I could not yet do in stage one when I was just focused on keeping the car between the curbs.

Similarly, my teacher would sometimes call my attention to different options I had. He would say, "You're going to need to turn left eventually so you can probably start looking for a safe opportunity to change lanes." He no longer had to tell me *how* to change lanes or exactly when to do it; but he continued to help me consider challenges that were farther "down the road."

AUTOMATIC STAGE

Toward the end of my supervised driving trips, we ventured into the big city of Cedar Rapids, which had an overwhelming population of 110,000 people (quite a bit bigger than the town of 5,000 residents in which I grew up and learned the basics of driving). Naturally, driving on these more populated streets provided challenges I had not yet experienced. I had to negotiate changing lanes in traffic while dealing with stoplights every block and being aware of significantly more vehicles on the road. Driving in the city meant practicing all the same skills I had been learning throughout my driver's educa-

tion (acceleration, braking, turning, adjusting to traffic, etc.), but I found it much more difficult to perform these tasks amid all the distractions of this new environment. I could easily see why these driving challenges were saved until the latter portion of my training.

As mentioned above, one of the characteristics of the third stage of motor learning (the automatic stage) is that you can execute skills in different settings, different situations, and among distractions. Although city driving provided plenty of distractions on its own, my instructor would sometimes create distracting tasks for me to accomplish while driving on the relatively distraction-free open highway. For instance, he would often ask me to turn on the radio and tune in to a particular station. Then he would ask me to change to a different station or adjust the volume or put a cassette (yes, a cassette) into the tape deck. Although trying to do too many things while driving (like texting) is known to be dangerous, a certain degree of multitasking is inevitable and has to be practiced. I recall the exciting day when my instructor allowed me to bring a soft drink into the car. While I thought that his ban on beverages was just an attempt to keep the upholstery free of soda stains, I suspect that he intentionally chose not to introduce that particular distraction until I was ready for it.

In the decades since I earned my license, the state of Iowa has implemented additional steps designed to measure progress and more gradually release restrictions. There is now an intermediate license, which allows 16 year old drivers to drive without adult supervision between 5:00 a.m. and 12:30 a.m. In order to earn a full license, drivers must be at least 17 years old, have a clean driving record as an intermediate-license holder for at least 12 consecutive months, and complete an additional 10 hours of supervised driving.[7] These added steps seem to be designed to further ensure that less experienced drivers can work their way to the automatic stage of learning progressively and safely.

CONCLUSION

Although I was not aware of the stages of learning when I was in driver's ed, I appreciate now how skillfully my instructor guided me through each stage by gradually adding challenges and by adjusting his feedback accordingly.

Once again, one of the main benefits I have found in calling students' attention to the stages of motor learning in the voice studio is that each stage comes without blame. Drivers are not born knowing how to maneuver three-point turns or how successfully to parallel park. Similarly, for most of us, a skill like learning how to sing smoothly through the *passaggio* must be practiced in order to be effectively implemented on different vowels, on different intervals, and at different dynamic levels. Singers who understand how the stages of motor learning work may be less likely to assume they are "untalented" if they are not yet in the automatic stage with every aspect of their singing.

This understanding has the added benefit of reminding students how important effort is in the learning process. Just as my driving instructor shifted from providing directions to asking questions, students know that when I start asking them more questions in lessons, it is not because I am trying to abdicate my responsibility as "the teacher"; rather, I am trying to engage them in a way that will help them develop their abilities to self-diagnose.

Having had my driver's license for nearly 30 years, it now seems strange to think that I ever would have been intimidated by driving in mild city traffic or that I would have had trouble passing a tractor on the highway. Similarly, I've been singing so long that it can be difficult to remember when I gained certain aspects of my technique and what it was like not to be able to make certain sounds.

But I know that I learned both skills the same way: gradually, over time, with lots of instruction, lots of mistakes, and lots of refining amid lots of repetition.

Perhaps the same process will help drive your students' success, as well.

NOTES

1. Lynn Helding, "Voice Science and Vocal Art, Part Two: Motor Learning Theory, *Journal of Singing* 64, no. 4 (March/April 2008): 417–428; Lynn Helding, "Motor Learning and Voice Training: Locus of Attention," *Journal of Singing* 72, no. 1 (September/October 2015): 87–91; Christine Bergan, "Motor Learning Principles and Voice Pedagogy: Theory and Practice," *Journal of Singing* 66, no. 4 (March/April 2010): 457–468; John Nix, "Best Practices: Using Exercise Physiology and Motor Learning Principles in the Teaching Studio and the Practice Room," *Journal of Singing* 74, no. 2 (November/

December 2017): 215–220; Lynn Maxfield, "Incorporating Motivation Into Your Model of Motor Learning," *Journal of Singing* 75, no. 5 (May/June 2019): 583–587.

2. Lynn Helding, *The Musician's Mind: Teaching, Learning, and Performance in the Age of Brain Science* (Lanham, MD: Rowman & Littlefield Publishing Group, Inc., 2020), xvi.
3. Two thorough explorations can be found in Ingo R. Titze and Katherine Verdolini Abbott, *Vocology: The Science and Practice of Voice Habilitation* (Salt Lake City, UT: National Center for Voice and Speech, 2012), and Helding, *The Musician's Mind.*
4. Wendy D. LeBorgne and Marci Rosenberg, *The Vocal Athlete* (San Diego, CA: Plural Publishing, Inc., 2020), 339–340.
5. Helding, *The Musician's Mind*, xxvi.
6. Ibid.
7. Iowa DOT: Driver's License/ID; https://iowadot.gov/mvd/driverslicense/under-18 (accessed October 24, 2020).